REMARKS

Upon entry of the present Preliminary Amendment-A the claims in the application are claims 1-6, 8-10 and 73-111, of which claims 1, 73, 79, 80, 81 and 95 are independent. No additional claim fees are believed to be required as applicant has previously paid for 57 total claims and 6 independent claims.

Claim 1 is amended to delete the features of dependent claim 7, which were incorporated therein in Amendment-B, and new independent claims 79, 80 are somewhat similar to claim 1, but define further aspects of the invention relating to measured characteristics of the composite structure of the invention when crystals forming the structure are measured by X-ray diffraction. New claims 81-111 are claims that were previously cancelled, but are being reintroduced into the application. New claims 81-94 exactly correspond to claims 11 and 13-25 previous cancelled, new claims 95-97 correspond to claims 26-28 previously cancelled, and claims 98-111 correspond to claims 57 and 59-71 previously cancelled.

New claims 79, 80 and 98-111 are directed to the invention Group I previously elected by applicant in response to the restriction requirement previously imposed by the Examiner, while new claims 81-94 are directed to non-elected Group II, and new claims 95-97 are directed to non-elected Group III.

Applicant respectfully submits that all of the above amendments are fully supported by the original application, including the original claims, and the discussion of the twelfth embodiments at paragraphs [0141]-[0143] and Tables 1 and 2. Applicant also respectfully submits that no new matter is added by the amendments.

Still further, applicant respectfully submits that the above amendment to claim 1

overcomes the rejection of this claim set forth at items 3-4 of the Office Action because the language to which the Examiner objects has been deleted from the claim. Accordingly, it is respectfully requested that the rejection be reconsidered and withdrawn.

Art-Based Rejections

1. In Item 6 of the Office Action, **the Examiner has rejected claims 1-5, 10, 73-74, and 78 under 35 USC 102(e) as being anticipated by Akedo et al., U.S. Patent No. 6,280,802 (Akedo '802).** It is the Examiner's belief that Akedo '802 discloses a substantially identical structure as the structure recited in applicant's claim 1, from which claims 2-5 and 10 depend, and as the structure recited in applicant's claim 73, of which claim 74 and 78 depend and therefore, the physical properties of presumed to be inherent and consequently identical.

Further in Item 6 of the Office Action, the Examiner states that the requirements of applicant's claim 2 are met because a film can be formed without the need for heat (column 12, lines 59-65) and that the requirements of applicant's claims 3-5 are met because the particle size ranges from 10nm - 5 μm, (column 2, line 50).

2. In Item 7 of the Office Action, **the Examiner has rejected claims 1-4, 10, 73-74 and 78 under 102(e) as being anticipated by U.S. Patent No. 6,531,187 (Akedo '187).** It is the Examiner's belief that Akedo '187 discloses an ultra-fine particle film wherein the particles are anchored to the substrate to form an underlying layer, wherein the materials used are brittle materials, and wherein the size of the crystallites ranges from 0.1-0.5μm, meeting the requirements of claim 1.

Further in Item 7, the Examiner stated that Akedo '187 meets the requirements of claim 73 for the same reasons previously discussed in relation to claim 1 and further stated that Akedo '187 also discloses a compactness of the ultra-fine particle film of 97%.

3. In Item 9 of the above-identified Office Action, **the Examiner rejected claims 8-9 and 75-77 under 35 USC 103(a) as being unpatentable over Akedo '802**. The Examiner states Akedo '802 discloses that if the particles to be deposited are oxide materials using air, oxygen, or other oxidizing agent, the oxygen deficiency in the oxides could be controlled, however, no aspect ratio of the crystals is disclosed. The Examiner further stated that if the deficiency can be controlled, it would be obvious to modify the amount of oxygen in order to generate a film with improved characteristics. The Examiner also stated that it would be obvious to modify the size of the particles and thus the aspect ratio in order to have a particle size which is not fused.

Applicant's Response

Upon careful consideration applicant respectfully traverses each of the above rejections, and submits that each of present claims 1-6, 8-10 and 73-78 is clearly patentably distinct over the Akedo '802 and Akedo '187 references, based on the following.

A. Initially, applicant respectfully submits that the composite structure defined by claim 1 is fundamentally distinct from the composite structures disclosed in the Akedo '802 and Akedo '187 references because the structures of the Akedo references exhibit crystal orientation, contrary to the requirements of claim 1, as explained further below.

In the composite structure according to the present invention, a polycrystalline structure made of a brittle material is formed on a surface of a substrate. A primary distinguishing feature

of the present invention is in that the polycrystalline structure substantially has no crystal orientation. In this point, the present invention is different from the prior art materials.

The technical conception of the present invention that a structure having no crystal orientation is formed is achieved by actively causing fine particles to be fractured at random when a brittle material structure is formed. According to a method of the present invention, the brittle material fine particles are caused to collide with a surface of a substrate, and the fine particles are fractured or deformed by the impact, so as to form a structure made of a fine particle material. Since the brittle material fine particles have a crystal face of various bonding energy, there are some cases where fracture or deformation easily occurs and other cases where it hardly ever occurs depending on the direction of the collision with the substrate and the direction of the crystal face. Therefore, if a structure is formed only by causing brittle material fine particles to collide with a substrate, fracture or deformation selectively occurs in each fine particle, which causes the formed structure to have orientation, or the fine particles are not fractured or deformed due to the relative angle between the collision direction and the crystal face, which causes the fine particles to bounce back and the formation speed to be low. In order to solve these problems, the present invention actively causes fine particles to be fractured at random, so that fracture or deformation is not affected by the crystal face of the fine particles. With this, the formation speed can be improved, and a structure having substantially no crystal orientation can be formed.

1. Evidence showing that the polycrystalline structure of the Akedo '187 and Akedo '802 materials has crystal orientation

The attached article "DEPOSITION METHOD USING ULTRAFINE PARTICLE

BEAM AND ITS APPLICATIONS", which was also written by one of the inventors of References 1 and 2, Jun Akedo, and published around the same time as Reference 1, shows that the polycrystalline structure of the prior art materials has crystal orientation. FIGS. 4-6 show XRD patterns of PZT, NiZn ferrite, and TiO_2, respectively. Incidentally, Akedo '802 discloses PZT and TiO_2 in the embodiment section.

The following is results of the integrated intensity calculation obtained from the XRD patterns of the present invention and the above-mentioned article based on the deviation of the integrated intensity defined in the present invention:

(a) Integrated intensity of the alumina structure described in the present invention

1) Deviation of integrated intensity with reference to JCPDS card 74-1081

Main peak	1	2	3	4
(hkl)	(121)	(120)	(110)	(132)
Deviation of integrated intensity		-	15.3%	10.8% 5.7%

2) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(121)	(120)	(110)	(132)
Deviation of integrated intensity		4.7%	10.8%	8.2%

The deviation of the integrated intensity is less than 30%.

(b) Integrated intensity of NiZn ferrite described in Article (corresponding to Akedo '802)

3) Deviation of integrated intensity with reference to JCPDS card 8-234

Main peak	1	2	3	4
(hkl)	(311)	(220)	(440)	(511)
Deviation of integrated intensity		62.2%	181.9%	72.7%

4) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(121)	(440)	(511)	(400)

Deviation of integrated intensity	99.1%	53.3%	579.8%	

The deviation of the integrated intensity exceeds 30%.

(c) Integrated intensity of PZT described in Article (corresponding to Akedo '802)

5) Deviation of integrated intensity with reference to JCPDS card 33-784

Main peak	1	2	3	4
(hkl)	(110)	(211)	(200)	(111)
Deviation of integrated intensity		67.6%	60.3%	25.3%

6) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(110)	(211)	(111)	(100)
Deviation of integrated intensity		12.0%	39.2%	11.4%

The deviation of the integrated intensity exceeds 30%.

(d) Integrated intensity of TiO_2 described in Article (corresponding to Akedo '802)

7) Deviation of integrated intensity with reference to JCPDS card 21-1272

Main peak	1	2	3	4
(hkl)	(101)	(200)	(105)	(004)
Deviation of integrated intensity		48.3%	9.4%	39.9%

8) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(101)	(200)	(105)	(004)
Deviation of integrated intensity		54.5%	11.6%	41.9%

The deviation of the integrated intensity exceeds 30%.

As reflected in the above data, the present inventors have determined that a structure having crystal orientation was formed at the time of the Akedo '802 and Akedo '187 when practicing the methods taught in these references. The present inventors consider that the deviation of the integrated intensity is 30% or less in the structure having no substantial crystal orientation.

The above results are, of course, consistent with the disadvantages associated with

Japanese Unexamined Patent Publication No. 2000-212766 (JP '766) as discussed in Background of the present application, e.g., undesirably results in a composite structure with insufficient peel strength and non-uniform density, noting that Akedo '802 corresponds to JP '766.

B. Additionally, regarding claim 73, applicant's claimed invention includes an average crystallite size of the formed structure of 50 nm or less and compactness thereof of 99% or more. The Akedo '802 reference makes no mention of the size of the crystallites formed, however, due to the step of irradiating the ultra-fine particles with an ion beam, an atomic beam, a molecular beam or a low temperature plasma, the discussed feature will not be achieved. Additionally, Akedo '187 discloses a density (compactness) of 97% which is not "99% or more" as required by applicant's claim 73.

C. Still further, we note that the US filing date of the Akedo '187 patent, 29 March 2000, is subsequent to the earliest priority date claimed by the present application, i.e., 12 October 1999 based on Japanese patent application 11-289904 (JP '904). Thus, Akedo '187 is not "prior art" to the present application.

D. Still further, applicant respectfully submits that the Akedo references fail to teach or make obvious features of the dependent claims. For example, relative to claims 8-9, directed to the features of a non-stoichiometric deficiency (oxygen) near the boundary face of the crystals forming the structure and controlling of same via the partial pressure of a component (oxygen) of the carrier gas used in a beam deposition method, the present application discloses that such deficiency is desirable for controlling various characteristics of the structure. In contrast, Akedo '802 discusses, at the paragraph bridging his cols. 12-13, compensating for any oxygen deficiency

by using oxygen as the gas source for his high-speed, high-energy beam to be irradiated. Thus, Akedo does not teach or suggest the claimed features, but teaches away therefrom.

Based on the foregoing, the rejections based on the Akedo '802 and Akedo '187 references are believed to be overcome in relation to present claims 1-5, 8-10 and 73-78 are believed to be overcome, and it is respectfully requested that the rejections be reconsidered and withdrawn.

Other Matters

Although the cover sheet of the Office Action indicates that claim 6 is rejected, in fact no rejection is presented against claim 6 in the Office Action.

New claims 79-80 are believed to be allowable over the references of record based on the above arguments relating to claim 1, and based on the additional features presented in these new claims, which are not taught or suggested by the Akedo references.

New claims 98-111 are believed to over the references of record based on the above arguments relating to claim 1.

CONCLUSION

For all of the above mentioned reasons, applicant requests reconsideration and withdrawal of the rejections of record, and allowance of all the pending claims. The application is believed to be in condition for allowance, and a Notice to this effect is earnestly solicited.

If the Examiner is not fully convinced of the allowability all of the claims now in the application, applicant respectfully requests that the Examiner telephonically contact applicant's undersigned representative to expeditiously resolve prosecution of the application.

Favorable reconsideration is respectfully requested.

Respectfully submitted,

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